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Formula and Conversion Sheet

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Formula/Conversion Table

$$\text{Acid Feed Rate} = \frac{(\text{Waste Flow})(\text{Waste Normality})}{\text{Acid Normality}}$$

$$\text{Alkalinity} = \frac{(\text{mL of Titrant})(\text{Acid Normality})(50{,}000)}{\text{mL of Sample}}$$

$$\text{Amperage} = \text{Voltage} \div \text{Ohms}$$

$$\text{Area of Circle} = (0.785)(\text{Diameter}^2) \text{ OR } (\pi)(\text{Radius}^2)$$

$$\text{Area of Rectangle} = (\text{Length})(\text{Width})$$

$$\text{Area of Triangle} = \frac{(\text{Base})(\text{Height})}{2}$$

$$\text{C factor slope} = \text{Energy loss, ft.} \div \text{Distance, ft.}$$

$$\text{C factor calculation} = \text{Flow, GPM} \div [193.75\ (\text{Diameter, ft.})^{2.63}(\text{Slope})^{0.54}]$$

$$\text{Chemical Feed Pump Setting, \% Stroke} = \frac{(\text{Desired Flow})(100\%)}{\text{Maximum Flow}}$$

$$\text{Chemical Feed Pump Setting, mL/min} = \frac{(\text{Flow, MGD})(\text{Dose, mg / L})(3.785\ \text{L / gal})(1{,}000{,}000\ \text{gal / MG})}{(\text{Liquid, mg / mL})(24\ \text{hr / day})(60\ \text{min / hr})}$$

$$\text{Chlorine demand (mg/L)} = \text{Chlorine dose (mg/L)} - \text{Chlorine residual (mg/L)}$$

$$\text{Circumference of Circle} = (3.141)(\text{Diameter})$$

$$\text{Composite Sample Single Portion} = \frac{(\text{Instantaneous Flow})(\text{Total Sample Volume})}{(\text{Number of Portions})(\text{Average Flow})}$$

$$\text{Detention Time} = \frac{\text{Volume}}{\text{Flow}}$$

$$\text{Digested Sludge Remaining, \%} = \frac{(\text{Raw Dry Solids})(\text{Ash Solids})(100\%)}{(\text{Digested Dry Solids})(\text{Digested Ash Solids})}$$

$$\text{Discharge} = \frac{\text{Volume}}{\text{Time}}$$

$$\text{Dosage, lbs/day} = (\text{mg/L})(8.34)(\text{MGD})$$

$$\text{Dry Polymer (lbs.)} = (\text{gal. of solution})(8.34\ \text{lbs/gal})(\%\ \text{polymer solution})$$

$$\text{Efficiency, \%} = \frac{(\text{In} - \text{Out})\ (100\%)}{\text{In}}$$

$$\text{Feed rate, lbs/day} = \frac{(\text{Dosage, mg / L})\ (\text{Capacity, MGD})(8.34\ \text{lbs / gal})}{(\text{Available fluoride ion})\ (\text{Purity})}$$

$$\text{Feed rate, gal/min (Saturator)} = \frac{(\text{Plant capacity, gal / min})\ (\text{Dosage, mg / L})}{(18{,}000\ \text{mg / L})}$$

$$\text{Filter Backwash Rate} = \frac{\text{Flow}}{\text{Filter Area}}$$

$$\text{Filter Yield, lbs/hr/sq ft} = \frac{(\text{Solids Loading, lbs / day})\ (\text{Recovery, \% / 100\%})}{(\text{Filter operation, hr / day})\ (\text{Area, ft}^2)}$$

$$\text{Flow, cu. ft./sec.} = (\text{Area, Sq. Ft.})(\text{Velocity, ft./sec.})$$

$$\text{Food/Microorganism Ratio} = \frac{\text{BOD, lbs / day}}{\text{MLVSS, lbs}}$$

$$\text{Gallons/Capita/Day} = \frac{\text{Gallons / Day}}{\text{Population}}$$

$$\text{Hardness} = \frac{(\text{mL of Titrant})\ (1{,}000)}{\text{mL of Sample}}$$

$$\text{Horsepower (brake)} = \frac{(\text{Flow, gpm})\ (\text{Head, ft})}{(3{,}960)\ (\text{Efficiency})}$$

$$\text{Horsepower (motor)} = \frac{(\text{Flow, gpm})\ (\text{Head, ft})}{(3960)\ (\text{Pump, Eff})\ (\text{Motor, Eff})}$$

$$\text{Horsepower (water)} = \frac{(\text{Flow, gpm})\ (\text{Head, ft})}{(3960)}$$

$$\text{Hydraulic Loading Rate} = \frac{\text{Flow}}{\text{Area}}$$

$$\text{Leakage (actual)} = \text{Leak rate (GPD)} \div [\text{Length (mi.)} \times \text{Diameter (in.)}]$$

$$\text{Mean} = \text{Sum of values} \div \text{total number of values}$$

$$\text{Mean Cell Residence Time (MCRT)} = \frac{\text{Suspended Solids in Aeration System, lbs}}{\text{SS Wasted, lbs / day} + \text{SS Lost, lbs / day}}$$

$$\text{Organic Loading Rate} = \frac{\text{Organic Load, lbs BOD / day}}{\text{Volume}}$$

$$\text{Oxygen Uptake} = \frac{\text{Oxygen Usage}}{\text{Time}}$$

$$\text{Percent efficiency} = [(\text{In} - \text{Out}) \div \text{In}] \times 100$$

$$\text{Population Equivalent} = \frac{(\text{Flow MGD})\,(\text{BOD, mg / L})\,(8.34\ \text{lbs / gal})}{\text{lbs BOD / day / person}}$$

$$\text{RAS Suspended Solids, mg/l} \quad \frac{1{,}000{,}000}{\text{SVI}}$$

$$\text{RAS Flow, MGD} \quad \frac{(\text{Infl. Flow, MGD})\,(\text{MLSS, mg/l})}{\text{RAS Susp. Sol., mg/l} - \text{MLSS, mg/l}}$$

$$\text{RAS Flow \%} \quad \frac{(\text{RAS Flow, MGD})\,(100\ \%)}{\text{Infl. Flow, MGD}}$$

$$\text{Reduction in Flow, \%} = \frac{(\text{Original Flow - Reduced Flow})(100\%)}{\text{Original Flow}}$$

$$\text{Slope} = \frac{\text{Drop or Rise}}{\text{Distance}}$$

$$\text{Sludge Age} = \frac{\text{Mixed Liquor Solids, lbs}}{\text{Primary Effluent Solids, lbs / day}}$$

$$\text{Sludge Index} = \frac{\text{\% Settleable Solids}}{\text{\% Suspended Solids}}$$

$$\text{Sludge Volume Index} = \frac{(\text{Settleable Solids, \%})\,(10{,}000)}{\text{MLSS, mg / L}}$$

$$\text{Solids, mg/L} = \frac{(\text{Dry Solids, grams})\,(1{,}000{,}000)}{\text{mL of sample}}$$

$$\text{Solids Applied, lbs/day} = (\text{Flow, MGD})(\text{Concentration, mg/L})(8.34\ \text{lbs/gal})$$

$$\text{Solids Concentration} = \frac{\text{Weight}}{\text{Volume}}$$

$$\text{Solids Loading, lbs/day/sq ft} = \frac{\text{Solids Applied, lbs / day}}{\text{Surface Area, sq ft}}$$

$$\text{Surface Loading Rate} = \frac{\text{Flow}}{\text{Area}}$$

$$\text{Total suspended solids (TSS), mg/L} = (\text{Dry weight, mg})(1{,}000\ \text{mL/L}) \div (\text{Sample vol., mL})$$

$$\text{Velocity} = \frac{\text{Flow}}{\text{Area}} \text{ or } \frac{\text{Distance}}{\text{Time}}$$

$$\text{Volatile Solids, \%} = \frac{(\text{Dry Solids} - \text{Ash Solids})\,(100\%)}{\text{Dry Solids}}$$

$$\text{Volume of Cone} = (1/3)(0.785)(\text{Diameter}^2)(\text{Height})$$

$$\text{Volume of Cylinder} = (0.785)(\text{Diameter}^2)(\text{Height}) \text{ OR } (\pi)(r^2)(h)$$

$$\text{Volume of Rectangle} = (\text{Length})(\text{Width})(\text{Height})$$

$$\text{Volume of Sphere} = [(\pi)(\text{diameter}^3)] \div 6$$

$$\text{Waste Milliequivalent} = (\text{mL})(\text{Normality})$$

$$\text{Waste Normality} = \frac{(\text{Titrant Volume})\,(\text{Titrant Normality})}{\text{Sample Volume}}$$

$$\text{Weir Overflow Rate} = \frac{\text{Flow}}{\text{Weir Length}}$$

Conversion Factors

1 acre = 43,560 square feet
1 cubic foot = 7.48 gallons
1 foot = 0.305 meters
1 gallon = 3.79 liters
1 gallon = 8.34 pounds
1 grain per gallon = 17.1 mg/L
1 horsepower = 0.746 kilowatts
1 million gallons per day = 694.45 gallons per minute
1 pound = 0.454 kilograms
1 pound per square inch = 2.31 feet of water
1% = 10,000 mg/L
Degrees Celsius = (Degrees Fahrenheit - 32) (5/9)
Degrees Fahrenheit = (Degrees Celsius * 9/5) + 32
64.7 grains = 1 cubic foot
1,000 meters = 1 kilometer
1,000 grams = 1 kilogram
1,000 milliliters = 1 liter
144 square inches = 1 square foot
1.55 cubic feet per second = 1 MGD
1 meter = 3.28 feet
$\pi = 3.141$

Abbreviations

BOD – biochemical oxygen demand
DO – dissolved oxygen
ft – feet
gpd – gallons per day
gpg – grains per gallon
gpm – gallons per minute
lbs – pounds
mg/L – milligrams per liter
MGD – millions of gallons per day
mL – milliliter
MLSS – mixed liquor suspended solids
MLVSS – mixed liquor volatile suspended solids
TSS – Total Suspended Solids